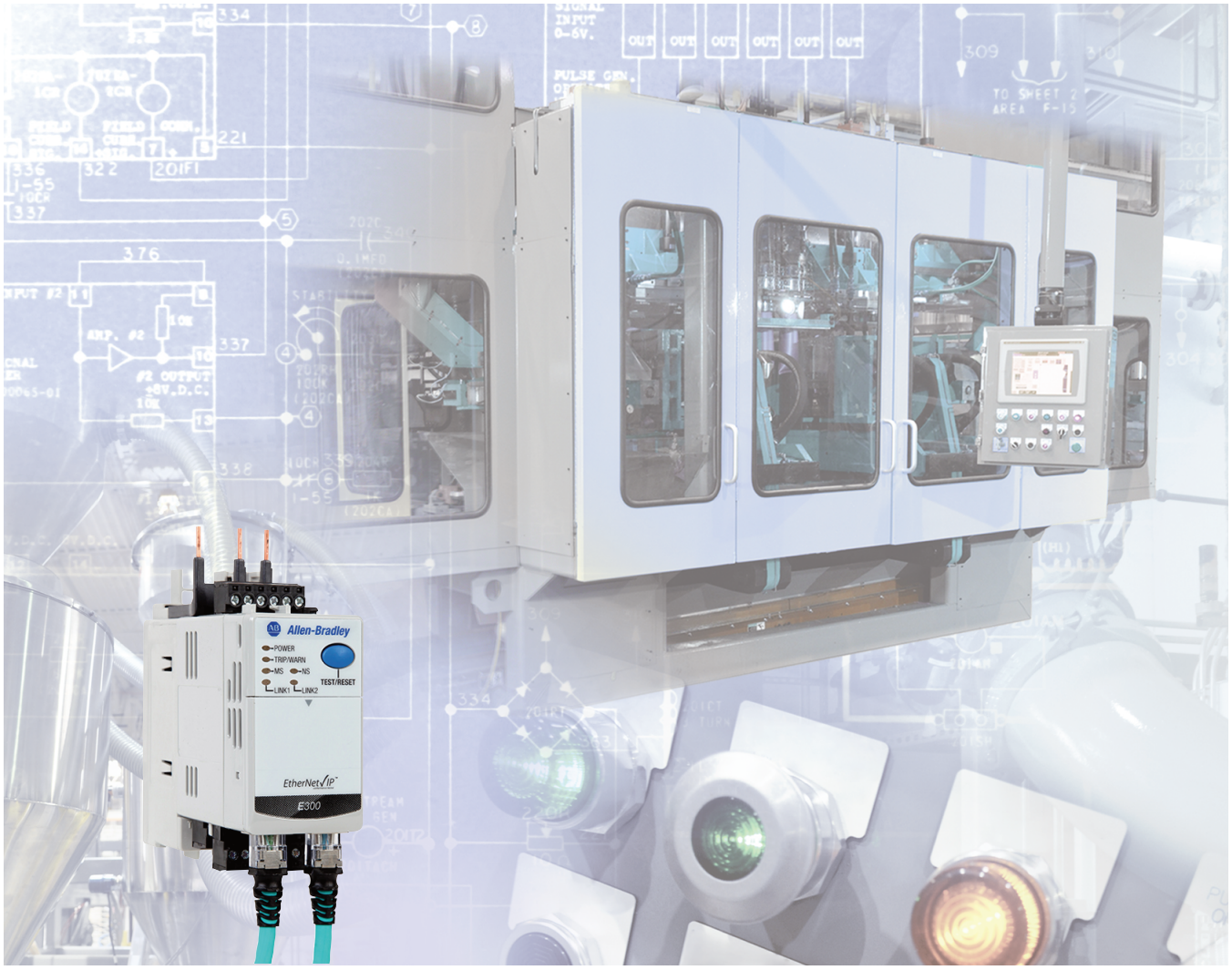
Selection Guide

Allen-Bradley

E300 Electronic Overload Relay

Bulletin 193/592



LISTEN. THINK. SOLVE.®

Allen-Bradley • Rockwell Software

Rockwell Automation

E300 Electronic Overload Relay

Overview

Bulletin 193-E300 Electronic Overload Relays

The E300 Electronic Overload Relay is the newest technology for overload protection. Its modular design, communication options, diagnostic information, simplified wiring, and integration into Logix make this the ideal overload for motor control applications in an automation system.

- Intelligent motor control (EtherNet/IP enabled)
- Scalable solution
- Diagnostic Information
- Integrated I/O
- Adjustable trip class 5…30
- Wide current range
- Test/Reset button
- Programmable trip and warning settings
- True RMS current/voltage sensing (50/60 Hz)
- Protection for single- and three-phase motors

Table of Contents

Product Overview ..... this page
Product Selection 5
Accessories 5
Specifications 6
Approximate Dimensions 10

Standards Compliance

EN 60947-4-1
CSA C22.2 No. 14
UL 508, UL1053 (class 1)

Certifications

CE
cULus Listed (File No. E14840, Guide NKCR, NKCR7; File No. E53935, Guide KDAX)
C-tick

NOTE: Your order must include 1) the Cat. No. of the sensing module, control module, and communication module selected, and 2) if required, Cat. No. of any accessories.

Product Overview

The E300 consists of three modules: sensing, control and communications. Users have choices in each of the three with additional accessories to tailor the electronic overload for their application's exact needs.

Sensing Module

Sensing Options
- Current/ground fault
- Current

Current Range [A]
- 0.5…30
- 6…60
- 10…100

Control Module

Control Voltage	I/O		I/O and Protection★	
	Inputs	Relay Outputs	Inputs	Relay Outputs
110…120V AC, 50/60 Hz	4	3	2	2
220…240V AC, 50/60 Hz	4	3	2	2

★ Includes PTC Thermistor and external ground fault

Communication Module

- EtherNet/IP

Expansion Digital I/O

Users can add up to four additional expansion digital modules to the E300 expansion bus.
- 4 Inputs/2 Relay Outputs
- 24V DC
- 120V AC
- 240V AC

Expansion Power Supply

When more than one expansion digital module and one operator station are added to the E300 expansion bus, an expansion power supply is needed to supplement power for the additional modules. One expansion power supply will power a fully loaded E300 expansion bus.
- 120/240V AC
- 24V DC

Expansion Operator Station

One operator station can be added to the E300 expansion bus to be used as a user interface device. The operator stations provide E300 status LEDs and function keys for motor control. The operator stations also support CopyCat™, which allows user to upload and download E300 configuration parameters.
- Control station

Thermal Overload

Thermal Utilization

The E300 Electronic Overload Relay provides overload protection through true RMS current measurement of the individual phase currents of the connected motor. Based on this information, a thermal model that simulates the actual heating of the motor is calculated. Percent of thermal capacity utilization (%TCU) reports this calculated value and can be read via a communications network. An overload trip occurs when the value reaches 100%.

Adjustable Settings

Thermal overload protection setup is accomplished simply by programming the motor's full load current (FLC) rating and the desired trip class (5…30). Programming of the actual values through software programming ensures the accuracy of the protection.

Thermal Memory

The E300 Electronic Overload Relay includes a thermal memory circuit designed to approximate the thermal decay for a trip class 20 setting. This means that the thermal model of the connected motor is maintained at all times, even if the supply power is removed.

Reset Modes

This flexibility allows the end-user in the ability to select between manual and automatic reset for an overload trip, allowing for broad application. The point of reset is user adjustable from 1…100% TCU.

Time to Trip

During an overload condition, the E300 Electronic Overload Relay provides an estimated time to trip that is accessible via a communications network. This allows corrective action to be taken so that production may continue uninterrupted.

Time to Reset

Following an overload trip, the E300 Electronic Overload Relay will not reset until the calculated percentage of thermal capacity utilization falls below the reset level. As this value decays, the time to reset, which is accessible via a communications network, is reported.

Thermal Warning

The E300 Electronic Overload Relay provides the capability to alert in the event of an impending overload trip. A thermal warning bit is set in the Warning Status when the calculated percentage of thermal capacity utilization exceeds the programmed thermal warning level, which has a setting range of 0…100% TCU.

Two-Speed Protection

The E300 Electronic Overload Relay offers a second FLA setting for 2-speed motor protection. What used to require two separate overload relays - one for each set of motor windings - can now be accomplished with one device. Improved protection is delivered as thermal utilization is maintained in one device during operation in both speeds.

Phase Loss

The E300 Electronic Overload Relay offers configurable phase loss protection, allowing the installer to enable or disable the function plus set a time delay setting, adjustable from 0.1…25.0 seconds. The trip level is factory-set at a current imbalance measurement of 100%.

Ground (Earth) Fault

The E300 Electronic Overload Relay incorporates zero sequence (core balance) sensing into its design for low level (arcing) ground fault detection. Trip and warning settings are adjustable from 20 mA…5.0 A. For devices rated greater than 200 A and for ground fault detection less than 1.0 A, the external core balance current transformer accessory is required. Class I protection is provided as defined by UL1053. The E300 Electronic Overload Relay provides a max. trip-inhibit setting, offering flexibility to prevent tripping when the ground fault current magnitude exceeds 6.5 A. This can be useful to guard against the opening of the controller when the fault current could potentially exceed the controller's interrupting capacity rating.

Note: The E300 Electronic Overload Relay is **not** a Ground Fault Circuit Interrupter for personnel protection as defined in article 100 of the U.S. National Electric Code.

Stall

"Stall" is defined as a condition where the motor is not able to reach full-speed operation in the appropriate amount of time required by the application. This can result in motor overheating as current draw is in excess of the motor's full load current rating.

The E300 Electronic Overload Relay provides user-adjustable stall protection. The trip setting has a range of 100…600% FLA, and the enable time is adjustable up to 250 seconds.

Jam (Overcurrent)

The E300 Electronic Overload Relay can respond quickly to take a motor off-line in the event of a mechanical jam, thereby reducing the potential for damage to the motor and the power transmission components.

Trip adjustments include a trip setting adjustable from 50…600% FLA and a trip delay time with a range of 0.1…25.0 seconds. A separate warning setting is adjustable from 50…600% FLA.

Underload (Undercurrent)

A sudden drop in motor current can signal conditions such as:

- Pump cavitation
- Tool breakage
- Belt breakage

For these instances, rapid fault detection can help minimize damage and aid in reducing production downtime.

Additionally, monitoring for an underload event can provide enhanced protection for motors that are coded by the medium handled (e.g., submersible pumps that pump water). Such motors can become overheated despite being underloaded. This can result from an absence or an insufficient amount of the medium (due to clogged filters, closed valves, etc.).

The E300 Electronic Overload Relay offers underload trip and warning settings adjustable from 10…100% FLA. The trip function also includes a trip delay time with a range of 0.1…25.0 seconds.

Current Imbalance (Asymmetry)

The E300 Electronic Overload Relay offers current imbalance trip and warning settings adjustable from 10…100%. The trip function also includes a trip delay time with a range of 0.1…25.0 seconds.

Remote Trip

The remote trip function allows an external device (e.g., a vibration sensor) to induce the E300 Electronic Overload Relay to trip. External device relay contacts are wired to the E300 Electronic Overload Relay discrete inputs. These discrete inputs are configurable with an option for assigning the remote trip function.

Current Monitoring Functions

The E300 Electronic Overload Relay allows the user to monitor the following operational data over a communications network:

- Individual phase currents — in amperes
- Individual phase currents — as a percentage of motor FLC
- Average current — in amperes
- Average current — as a percentage of motor FLC
- Percentage of thermal capacity utilized
- Current imbalance percentage
- Ground fault current

Diagnostic Functions

The E300 Electronic Overload Relay allows the user to monitor the following diagnostic information over the DeviceNet network:

- Device status
- Trip status
- Warning status
- Time to an overload trip
- Time to reset after an overload trip
- History of past five trips
- History of positive warnings
- Hours of operation
- Number of starts
- Trip snapshot

Status Indicators

The E300 Electronic Overload Relay provides the following LED indicators:

- **Power —** This green/red LED indicates the status of the overload relay.
- **TRIP/WARN —** This LED flashes a yellow code under a warning condition and a red code when tripped.

Inputs/Outputs

Inputs allow the connection of such devices as contactor and disconnect auxiliary contacts, pilot devices, limit switches, and float switches. Input status can be monitored via the network and mapped to a controller's input image table. Inputs are rated 24V DC, 120V AC, or 240V AC and are current sinking. Power for the inputs is sourced separately with convenient customer sources at terminal A1. Relay contact outputs can be controlled via the network or DeviceLogix function blocks for performing such tasks as contactor operation.

Test/Reset Button

The Test/Reset button, located on the front of the E300 Electronic Overload Relay, allows the user to perform the following:

- **Test** — The trip relay contact will open if the E300 Electronic Overload Relay is in an untripped condition and the Test/Reset button is pressed for 2 seconds or longer.
- **Reset —** The trip relay contact will close if the E300 Electronic Overload Relay is in a tripped condition, supply voltage is present, and the Test/Reset button is pressed.

Single/Three-Phase Operation

The E300 Electronic Overload Relay can be applied to three-phase as well as single-phase applications. A programming parameter is provided for selection between single- and three-phase operation. Straight-through wiring is afforded in both cases.

EtherNet/IP Communications

The E300 EtherNet/IP communication module has two RJ45 ports that act as an Ethernet switch to support a star, linear, and ring topology and supports the following:

- 2 concurrent Class 1 connections [1 exclusive owner + (1 input only or 1 listen only)]
- 6 simultaneously Class 3 connections (explicit messaging)
- Embedded web server
- SMPT server for trip and warning events
- Embedded EDS file
- RSLogix 5000 add-on profile

For more information on operation and maintenance of this product, please reference the user manual, publication 193-UM0015*.

Bulletin 193/592-E300 Electronic Overload Relays
Sensing Modules

Description	Mounting Options	Current Range [A]	For Use With	Cat. No.
Current Sensing Module	IEC Contactors	0.5…30	100-C09…C23	193-ESM-I-30A-C23
		0.5…30	100-C30…C55	193-ESM-I-30A-C55
		6…60	100-C30…C55	193-ESM-I-60A-C55
	DIN Rail / Panel Mount Power Terminals	0.5…30	Line- and load-side power conductor terminals. Directly replaces 193-ECPM_	193-ESM-I-30A-E3T
		6…60		193-ESM-I-60A-E3T
	NEMA Contactors	0.5…30	NEMA Size 0…2	592-ESM-I-30A-S2
		6…60		592-ESM-I-60A-S2
Current/Ground Fault Sensing Module	IEC Contactors	0.5…30	100-C09…C23	193-ESM-IG-30A-C23
		0.5…30	100-C30…C55	193-ESM-IG-30A-C55
		6…60	100-C30…C55	193-ESM-IG-60A-C55
	DIN Rail / Panel Mount Power Terminals	0.5…30	Line- and load-side power conductor terminals. Directly replaces 193-ECPM_	193-ESM-IG-30A-E3T
		6…60		193-ESM-IG-60A-E3T
	NEMA Contactors	0.5…30	NEMA Size 0…2	592-ESM-IG-30A-S2
		6…60		592-ESM-IG-60A-S2

Control, Communication, and Expansion Modules

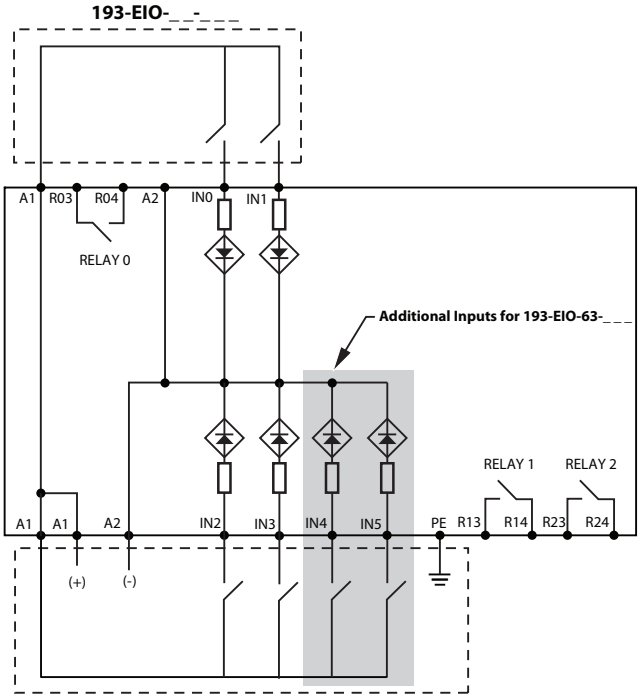
Description		No. of Inputs/Outputs	Rated Control Voltage [V]	Cat. No.
Control Module	I/O Module	4 In/3 Out	110…120V AC, 50/60 Hz	193-EIO-43-120
		4 In/3 Out	220…240V AC, 50/60 Hz	193-EIO-43-240
Communication Module	EtherNet/IP Communication Module	—	—	193-ECM-ETR
Expansion Module	Digital Expansion Module 120V AC	4 In / 2 Out	110…120V AC, 50/60 Hz	193-EXP-DIO-42-120
	Digital Expansion Module 240V AC	4 In / 2 Out	220…240V AC, 50/60 Hz	193-EXP-DIO-42-240
	Digital Expansion Module 24V DC	4 In / 2 Out	24V DC	193-EXP-DIO-42-24D
	Expansion Power Supply	—	110…240V AC, 50/60 Hz	193-EXP-PS-AC
		—	24V DC	193-EXP-PS-DC

Accessories

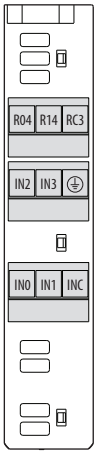
Description	For Use With	Cat. No.
Starter Control Station with 3 Meter Cable	—	193-EOS-SCS
Contactor Coil Module	100-C23 contactors	193-EIO-CM-C23
	100-C55 contactors	193-EIO-CM-C55
1 Meter Expansion Module Cable	—	193-EXP-CBL-1M
3 Meter Expansion Module Cable	—	193-EXP-CBL-3M
Replacement Connector	120/240V AC 4:3 Control Modules	193-NCIO-43-CNT
	Digital Expansion Modules	193-NCXP-DIO-CNT
	Expansion Power Supply	193-NCXP-PS-CNT

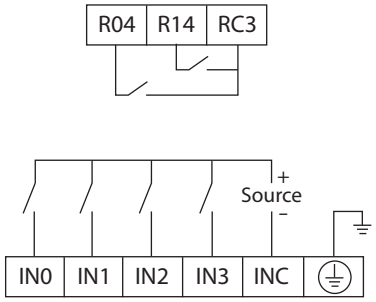
Wiring Diagrams

Control Module

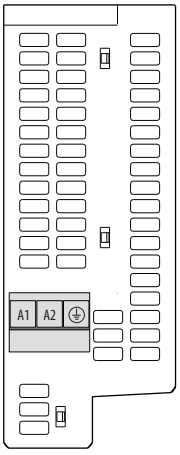


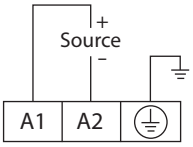
Expansion Digital I/O Modules 193-EXP-DIO-__





Expansion Power Supplies 193-EXP-PS-__





Electrical Specifications

Motor/Load Ratings

Terminals	1/L1, 3/L2, 5/L3, 2/T1, 4/T2, 6/T3
Rated Insulation Voltage (Ui)	690V AC
Rated Operating Voltage (Ue)	
IEC:	690V AC
UL:	600V AC
Rated Impulse Voltage (U_{imp})	6 kV
Rated Operating Current (I_e)	See Catalog Number Explanation
Rated Frequency	45...65 Hz ★
Short Circuit Ratings	See user manual
Number of Poles	3
Application	Single-phase or Three-phase

★ Exception: Any E300 Overload Relay that uses an external ground fault sensor is limited to 50/60 Hz detection.

Power Supply Ratings

Rated Supply Voltage (U_s)	120V AC	240V AC
Operating Range	85…132V AC	159…265V AC
Maximum Inrush Current	6 A	
Maximum Power Consumption		
E300:	6 W	
E300 with expansion:	8 W	
Maximum Power Interruption Time		
Vmin:	10 ms	10 ms
Vmax:	10 ms	10 ms

Output Relay Ratings (Control Module and Expansion Digital Module)

Terminals	
Relay 0:	R03/R04
Relay 1:	R13/R14
Relay 2:	R23/R24
Type of Contacts	Form A SPST - NO
Rated Thermal Current (I_{the})	5 A
Rated Insulation Voltage (U_i)	300V AC
Rated Operating Voltage (U_e)	250V AC
Rated Operating Current (I_e)	3 A (@120V AC), 1.5 A (@240V AC) 0.25 A (@110V DC), 0.1 A (@220V DC)
Minimum Operating Current	10 mA @ 5V DC
Rating Designation	B300
Utilization Category	AC-15
Resistive Load Rating (p.f. = 1.0)	5 A, 250V AC 5 A, 30V DC
Inductive Load Rating (p.f. = 0.4) (L/R = 7 ms)	2 A, 250V AC 2 A, 30V DC
Short Circuit Current Rating	1,000 A
Recommended Control Circuit Fuse	KTK-R-6 (6 A, 600 V)
Rated Number of Operations	
Relay 0, Relay 1, and Relay 2: W/100-C09…100-C43 W/100-C60…100-C97 W/NEMA Size 0…2 W/NEMA Size 3	5,000,000 2,500,000 1,000,000 300,000

Input Ratings (Control Module and Expansion Digital Module)

Terminals			
Input 0: Input 1: Input 2: Input 3: Input 4: Input 5:	IN0 IN1 IN2 IN3 IN4 IN5		
Supply Voltage	24V DC	120V AC	240V AC
Type of Inputs	Current Sinking		
On-State Voltage	11V DC	74V AC	159V AC
On-State Current (turn-on)	2 mA	5 mA	5 mA
Off-State Voltage	5V DC	20V AC	40V AC
Off-State Current	1.5 mA	2.5 mA	2.5 mA
Transition Voltage	5...11V DC	20…74V AC	40…159V AC
Transition Current	1.5...2.0 mA	2.5…5 mA	2.5…5 mA

Low Voltage Directive

The E300 Electronic Overload Relay expansion digital modules are tested to comply with EN60947-5-1 Low-voltage switchgear and controlgear Part 5-1: Control circuit devices and switching elements.

Expansion Digital I/O Modules

Expansion Digital I/O Modules	193-EXP-DIO-42-24D	193-EXP-DIO-42-120	193-EXP-DIO-42-240
Digital Output Rated Operational Voltage (U_e):	250V AC	250V AC	250V AC
Digital Output Rated Insulation Voltage (U_i):	2000Vrms for 1s	2000Vrms for 1s	2000Vrms for 1s
Rated Impulse Withstand Voltage (U_{imp}):	NA	NA	NA
Conditional Short Circuit Current:	1000 A	1000 A	1000 A
Recommended Control Circuit Fuse:	KTK-R (6 A, 600V)	KTK-R (6 A, 600V)	KTK-R (6 A, 600V)
Utilization Category:	AC15, DC13	AC15, DC13	AC15, DC13
Pollution Degree:	3	3	3

Expansion Power Supply Modules

Expansion Power Supply Modules	193-EXP-PS-AC
Rated Operational Voltage (U_e):	100…250V AC
Rated Insulation Voltage (U_i):	2640Vrms for 1s
Rated Impulse Withstand Voltage (U_{imp}):	4 kV
Conditional Short Circuit Current:	NA
Protection Against Short Circuits:	NA
Utilization Category:	NA
Pollution Degree:	3

Environmental Specifications

Ambient Temperature	
Storage Operating (Open) (Enclosed)	–40…+85 °C (–40…+185 °F) –20…+55 °C (–4…+131 °F) –20…+40 °C (–4…+104 °F)
Humidity	
Operating Damp Heat – Steady State (per IEC 68-2-3) Damp Heat – Cyclic (per IEC 68-2-30)	5…95% Non-condensing 92% r.h., 40 °C (104 °F), 56 days 93% r.h., 25 °C/40 °C (77 °F/104 °F), 21 Cycles
Cooling Method	Natural Convection
Vibration (per IEC 68-2-6)	2.5G operating, 5 G non-operating
Shock (per IEC 68-2-27)	30 G
Maximum Altitude	2000 m ★
Pollution Environment	Pollution Degree 3
Terminal Marking	EN 50012
Degree of Protection	IP20

★ Exception: Any E300 Overload Relay that uses an external ground fault sensor is limited to 50/60 Hz detection.

Note: The E300 Electronic Overload Relay expansion power supplies (Cat. Nos. 193-EXP-PS-AC and 193-EXP-PS-DC) surrounding air temperature must not exceed 55 °C (131 °F).

Electromagnetic Compatibility Specifications

Electrostatic Discharge Immunity	
Test Level: Performance Criteria:	8kV Air Discharge 6kV Contact Discharge 1 ★‡
RF Immunity	
Test Level: Performance Criteria:	10V/m 1 ★‡
Electrical Fast Transient/Burst Immunity	
Test Level: Performance Criteria:	4kV (Power) 2kV (Control & Comm) 1 ★‡
Surge Immunity	
Test Level: Performance Criteria:	2kV (L-E) 1kV (L-L) 1 ★‡
Radiated Emissions	Class A
Conducted Emissions	Class A

★ Performance Criteria 1 requires the DUT to experience no degradation or loss of performance.

‡ Environment 2.

Protection

Protection

	Trip	Warning
Overload	Yes	Yes
Phase Loss	Yes	No
Ground Fault	Yes	Yes
Stall	Yes	No
Jam	Yes	Yes
Underload	Yes	Yes
Thermistor (PTC)	Yes	Yes
Current Imbalance	Yes	Yes
Communication Fault	Yes	Yes
Communication Idle	Yes	Yes
Remote Trip	Yes	No
Blocked Start/Start Inhibit	Yes	No
Under Voltage L-L	Yes	Yes
Over Voltage L-L	Yes	Yes
Voltage Unbalance	Yes	Yes
Phase Rotation	Yes	Yes

Overload Protection

Type of Relay	Ambient Compensated Time-Delay Phase Loss Sensitive
Nature of Relay	Solid-State
FLA Setting	See user manual
Trip Rating	120% FLA
Trip Class	5…30
Reset Mode	Automatic or Manual
Overload Reset Level	1…100% TCU

Ground Fault Protection (External Ground Fault Module)

Type	Core Balanced
Intended Use	Equipment Protection
Classification (Per UL 1053)	Class I
Protection Range	20…100 mA
	100…500 mA
	200 mA…1.0 A
	1.0…5.0 A
Trip & Warning Time Delay	0.1…25.0 s
Protection Inhibit Time	0…250 s

Accuracy

Metering

The E300 Electronic Overload Relay metering accuracy is listed below:

Current	±2% of Sensing Module Current Range

Protection Timers

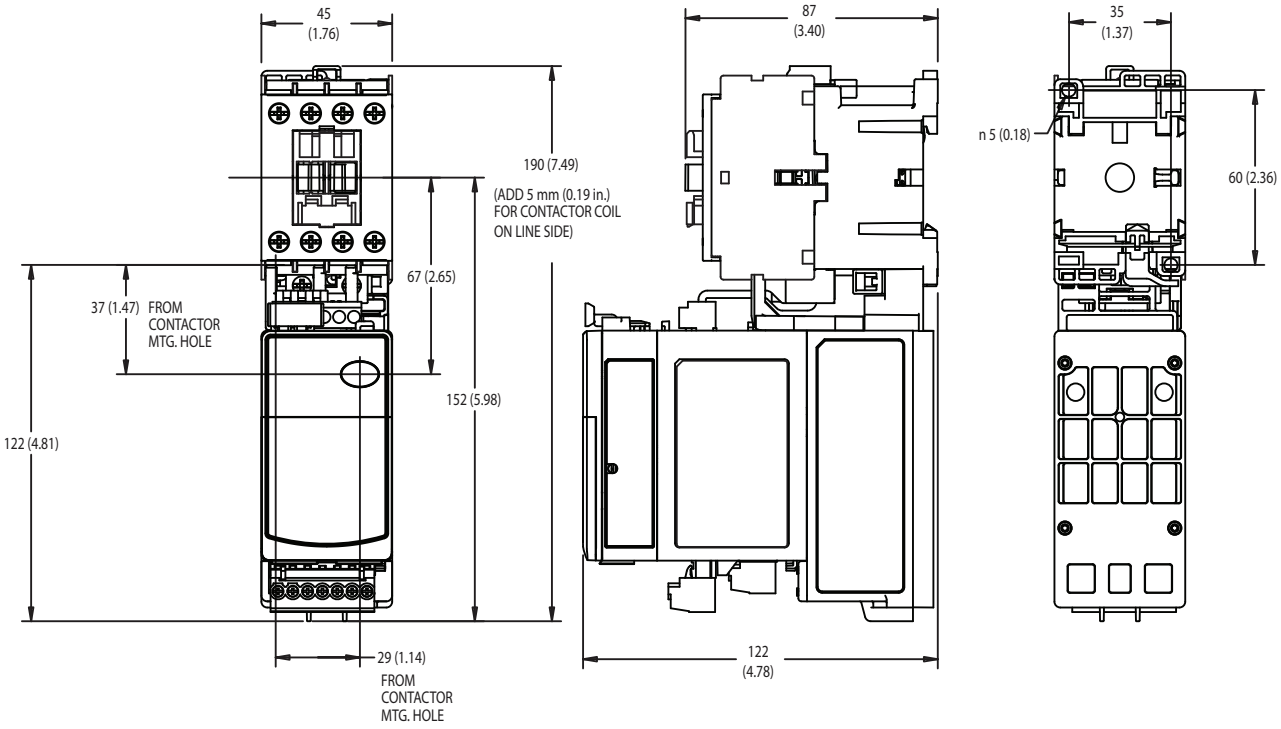
All E300 Electronic Overload Relay trip timers have a resolution of ±0.1 s or 0.1 s/25 s (whichever is greater).

E300 Electronic Overload Relay

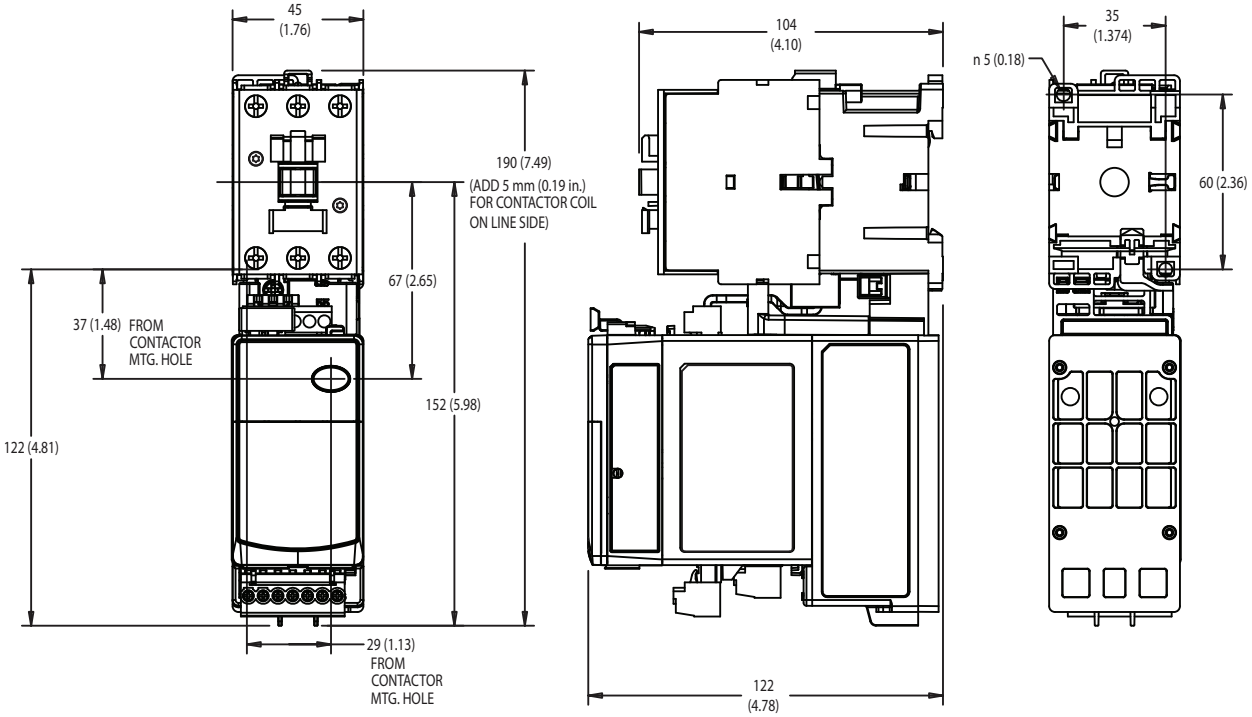
Approximate Dimensions

Approximate dimensions are shown in millimeters (inches). Dimensions are not to be used for manufacturing purposes.

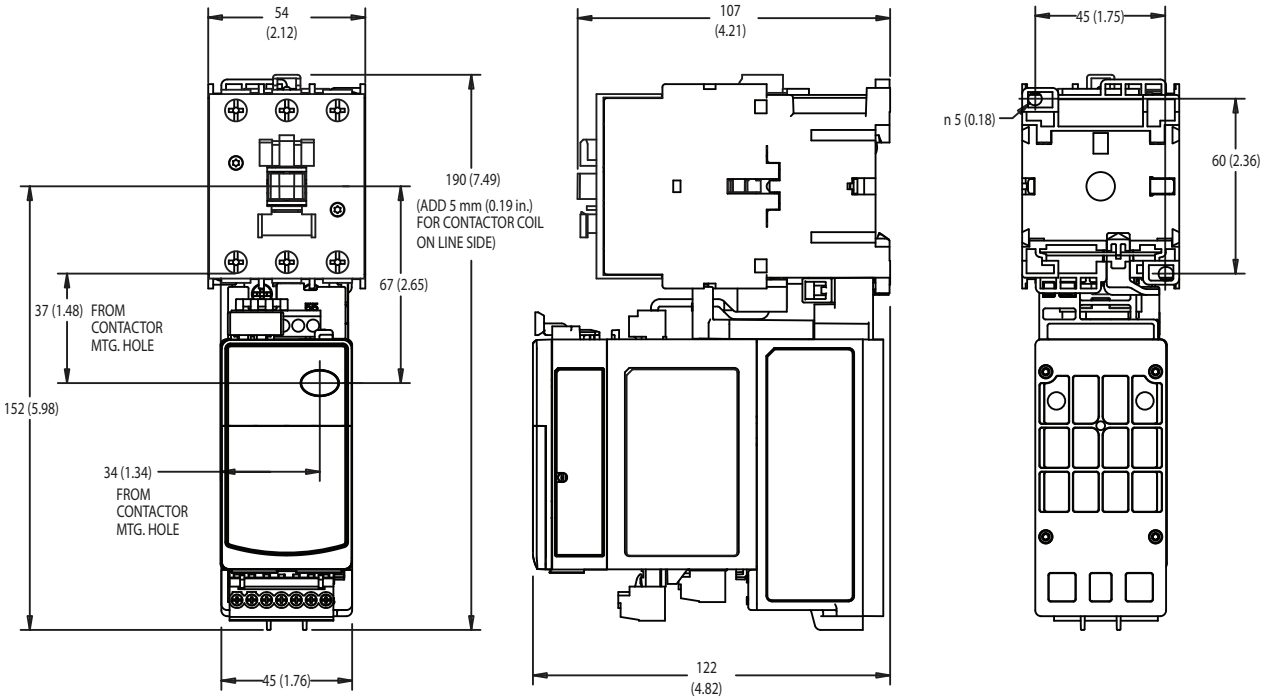
E300 Overload Relay Mounted on Bulletin 100-C09…-C23 Contactor



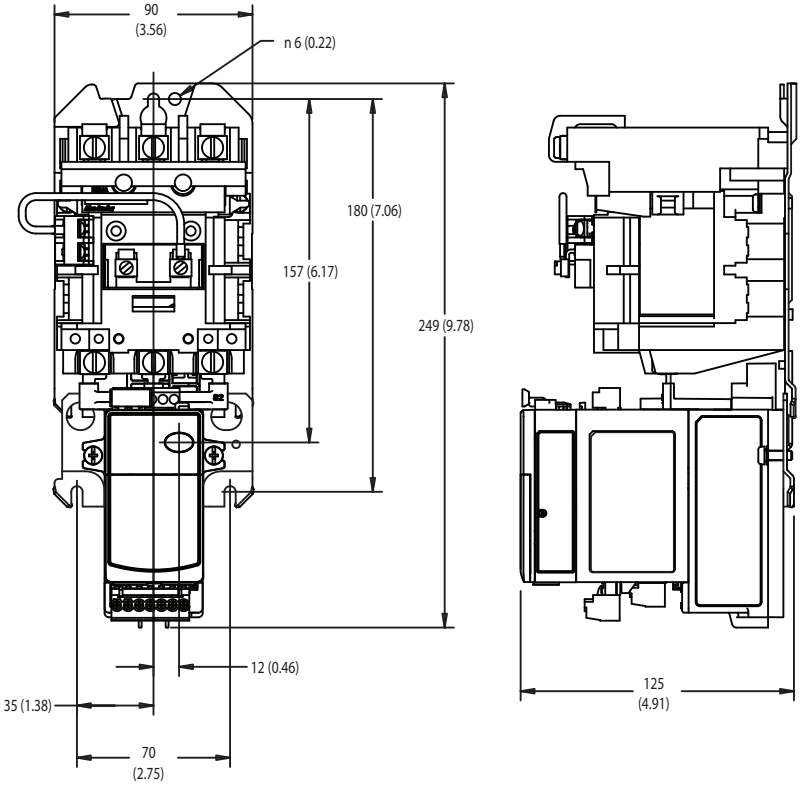
E300 Overload Relay Mounted on Bulletin 100-C30…-C37 Contactor



E300 Overload Relay Mounted on Bulletin 100-C43…-C55 Contactor



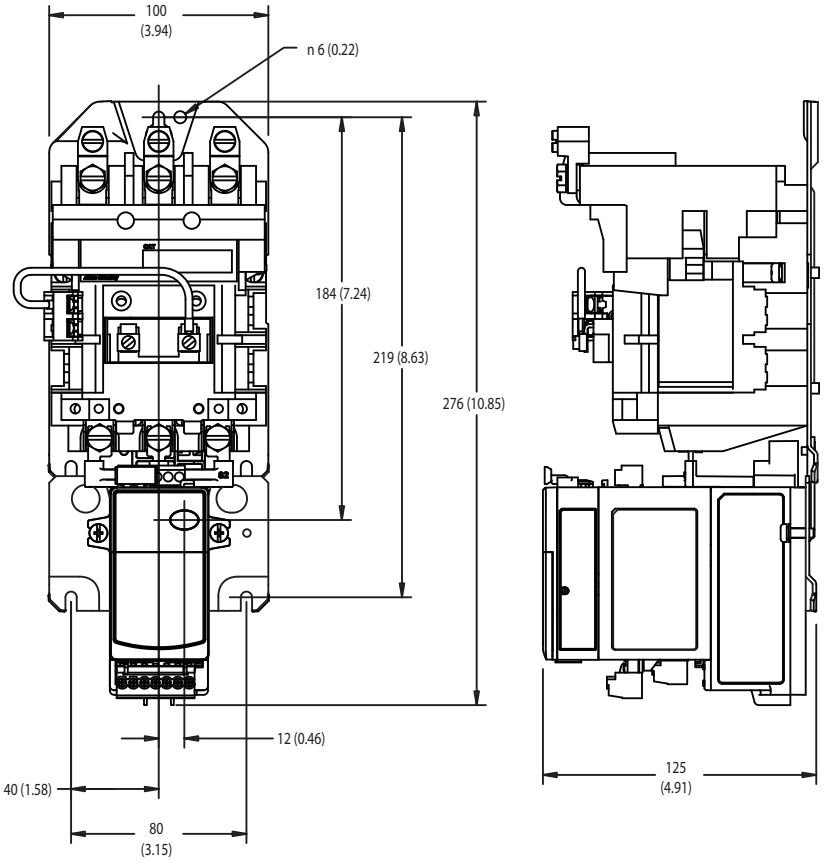
E300 Overload Relay Mounted on Bulletin 500 NEMA Size 0 and Size 1 Contactor



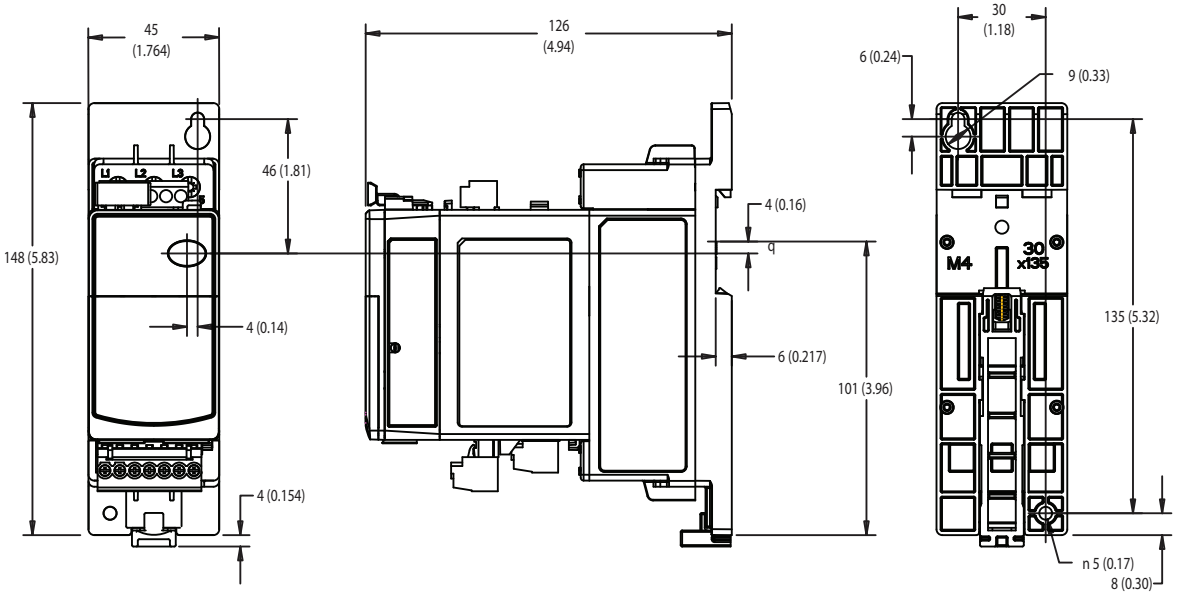
E300 Electronic Overload Relay

Approximate Dimensions

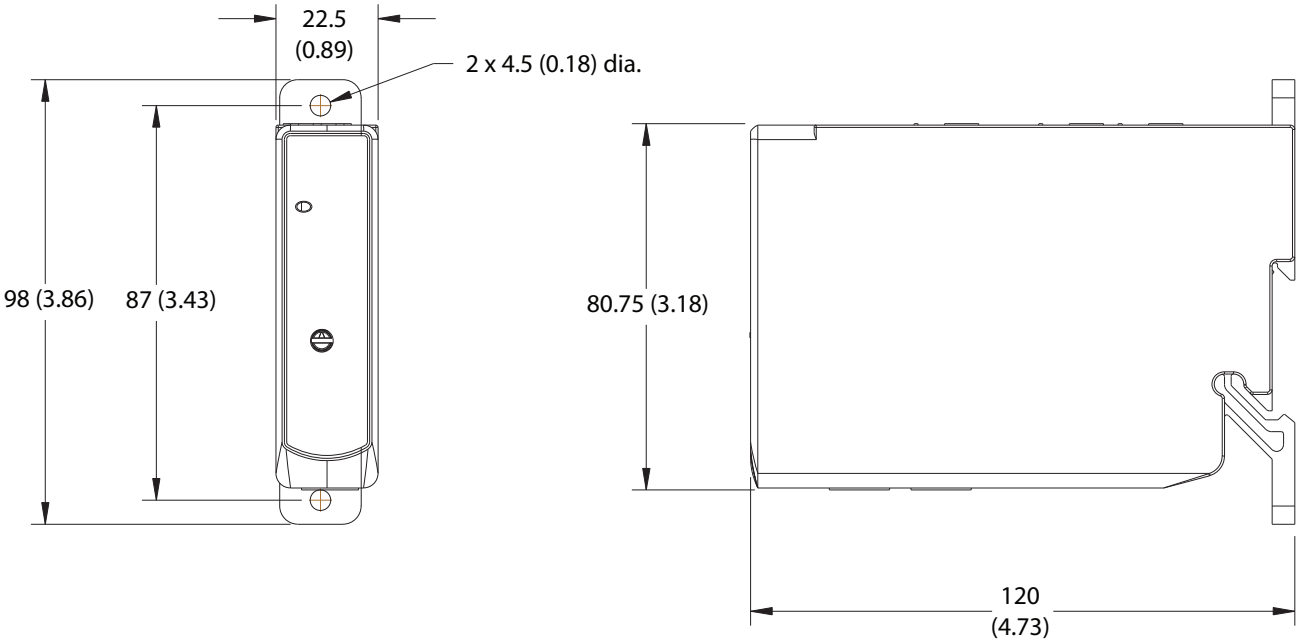
E300 Overload Relay Mounted on Bulletin 500 NEMA Size 2 Contactor



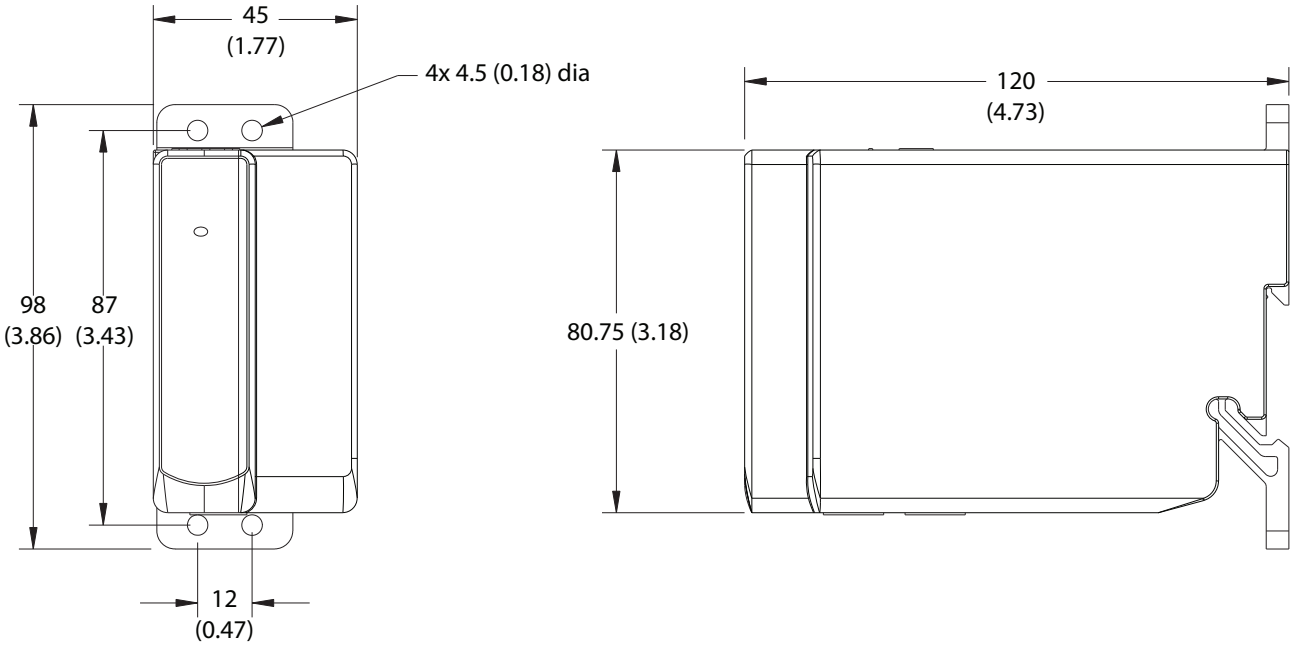
E300 Overload Relay, DIN Rail/Panel Mounted



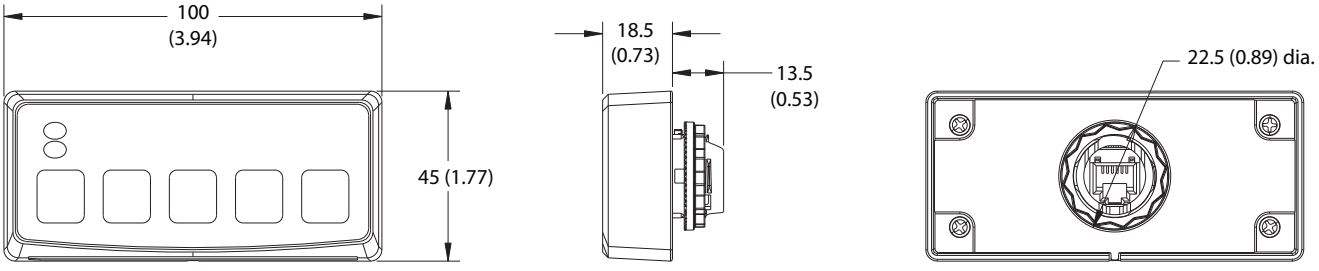
E300 Digital Expansion Module 193-EXP-DIO-___



E300 Expansion Power Supply 193-EXP-PS-___



E300 Starter Control Station 193-EOS-SCS



Allen-Bradley, Rockwell Software, Rockwell Automation, and LISTEN. THINK. SOLVE are trademarks of Rockwell Automation, Inc.
Trademarks not belonging to Rockwell Automation are property of their respective companies.

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 193-SG010A-EN-P - December 2013

Copyright © 2013 Rockwell Automation, Inc. All rights reserved. Printed in the U.S.A.